CONFIDENTIAL

DRAM 64-0354

Executive Registry
64-319
NPIC D-71-64

MEMORANDUM FOR: Deputy Director of Central Intelligence

VIA : Assistant Deputy Director (Intelligence) for Management

Executive Director - Comptroller

SUBJECT : Research and Development Project Approval Request for a High-Resolution-Step-and-Repeat-Contact Printer

REFERENCE : DDCI Memo ER 63-86121, dated 23 December 1963: Approval of Research and Development Activities

In compliance with paragraph 4.b. of the reference, it is requested that the procurement of a High-Resolution-Step-and-Repeat-Contact Printer,

25X1 [redacted] outlined in Annex "A" be approved.

ARTHUR C. LUNDAHL
Director
National Photographic Interpretation Center

CONCURRENCES:

/s/
Paul A. Borel
Assistant Deputy Director (Intelligence) for Management

28-4-64
Date

Lyman B. Kirkpatrick
Executive Director - Comptroller

Date

Declass Review by NGA.

SUBJECT: Research and Development Project Approval Request for a High-Resolution-Step-and-Repeat-Contact Printer

APPROVED:

1 MAY 1964

(signed) Lyman B. Kirkpatrick

25X1 [redacted]

Lieutenant General, USA
Deputy Director of Central Intelligence

Date

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25X1 NPIC/P&DS/DB: [redacted] (22 April 1964)

Research and Development
Project Approval Request

I. Identification

This program covers the development of a High-Resolution Step-and-Repeat Contact Printer which would come under the Technical Development Program of the Plans and Development Staff, NPIC, at a total estimated cost [redacted] The item was included in the NPIC financial plan for Fiscal Year 1964 at the [redacted] level under the category "Reproduction and Processing Equipment." The additional funds are available within the approved budget.

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A second printer known as the Contact Duplicating and Reseau Printer will be included as an "add-on" to this same procurement because of its fundamental similarities to the High-Resolution Printer. The Reseau Printer will be for GIMRADA and will be funded by that Agency at a total estimated cost of [redacted] The actual bid prices are shown in paragraph V.

25X1

The costs stated above represent a pro-rated reduction of [redacted] in the total contract price on the basis of developing both the NPIC printer and the GIMRADA printer under the same contract. This amounts to a saving [redacted] to GIMRADA by joint procurement.

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II. Objectives

The overall objective of this program is to develop a step-and-repeat contact roll printer incorporating the most advanced features in the technology of image transfer to achieve image quality superior to that of equipment presently available to the exploitation community and with operational flexibility in excess of any available equipment or printing system.

The primary objectives are to develop a flat-bed, step-and-repeat contact printer (image transfer device) capable of achieving a modulation transfer function as near unity as possible at all acquired frequencies in order to assure the production of duplicate prints with the least possible loss in image quality and with the lowest possible image distortion during the information transfer (printing) process. Other major objectives are: (1) to provide automatic exposure control as a necessary feature to assure maximum resolution; (2) automatic dodging (manipulation of exposure modulation) to facilitate accentuation of minor differences in minute adjacent densities; (3) programmed printing of preselected frames from code marks; (4) automated multiple printing of selected frames; (5) automatic dust removal by electrostatics, vacuum or other means; and (6) localized clean-room atmosphere within the printing chamber.

III. Background

Operating Divisions at the NPIC require the generation of additional film copies in the form of duplicate negatives and positives. One item essential to the duplication process is the contact printer. To date, virtually all large volume printing, strip printing and long frame printing is being accomplished by means of a continuous strip printing technique in

which the original and the duplicating material are brought into contact over a revolving drum and exposed from a light source directed towards the drum's outer surface through a slit aperture. Prints to be used for mensuration and other prints requiring absolute maximum quality are produced on a manually-operated, single-frame, flat-bed printer. The revolving drum printer has been a reliable standard and produces generally acceptable quality for the inputs received in the past. However, studies of the principles employed have revealed certain inherent shortcomings. It has been recognized that transfer response losses occur because of the different circumferences of the respective negative and duplicate film strands around the printing drum: the reliability of mensuration techniques has suffered because of resulting image distortion. Maximum possible contact between the two films is not achieved because of surface irregularities. The system does not lend itself to selective printing of single frames or multiple printing from selected frames. In addition, it would be difficult to incorporate automatic exposure control, and inclusion of automatic dodging in the system would be even more difficult.

The manually-operated, single-frame, flat-bed printer is capable of producing extremely high quality when prints are carefully handled. However, the printer has absolutely no automated features. It is therefore prohibitively slow for all but the most specialized printing applications. Furthermore, its maximum frame accommodation is only 18 inches long, which is too short for printing long-frame exposures produced by modern acquisition systems.

Until recently, these inherent printing deficiencies were of little consequence. Now that photographic exploitation has increased in volume and is being developed to a more exacting science day by day, as detailed targets are being identified and measured, it has become imperative to advance the state-of-the art in image transfer equipment and techniques. Moreover, our exploitation capabilities must run ahead of, not keep pace with, the quality of current acquisitions.

The development would overcome many of the known deficiencies in existing image transfer equipment and techniques. At the same time, it is capable of attaining greater quality in image transfer contact printing, as well as an operational flexibility not available with existing equipment. The proposed printer is expected to achieve image resolution far in excess of existing production printing equipment. By flat-bed printing and advanced film transport mechanisms, it is expected that image distortion in the printing stage will be virtually eliminated. A printing speed of 10 frames per minute was specified in the hope that such a printing rate may prove feasible and that flat-bed printing may become competitive with mass-strip printing procedures. Automatic exposure control was considered indispensable because of the great importance of correct exposure in maximum resolution. Automatic dodging, although difficult to achieve at high frequencies, could provide significant advances in readability by appropriate manipulation of densities contained in microscopic images. Film cleaning, or at least dust removal (just prior to exposure), is another must for maximum quality. The requirement for clean-room environment within the printer enclosure is in keeping with the present-day philosophy for absolute image quality.

Other advantages can be expected to accrue from this composite development. Operationally, at NPIC, reprints are frequently ordered on a specific frame basis, from a mission run, in lieu of ordering a reprint of the entire roll. This can be accomplished more readily on the proposed automatic flat-bed printer than on a drum-type strip printer, with a considerable saving of film as well as a saving in printing and processing time. It is proposed that this be accomplished by coding all frames of the roll so that the coding can be sensed by the printer to automatically print the preselected frames at the exclusion of those having no interest or value for the immediate task.

The use of stereo-pairs has become of considerable and increasing value and importance. To bring stereo-pairs into adjacent position for stereo viewing, special accumulator mechanisms have been designed and built into viewers to accommodate the slack frames between the selected pairs. Rather than continue this procedure, it would be more desirable to print the stereo-pairs adjacent at the time prints are made to allow viewing with standard stereoscopes, without requiring complex accumulator devices. Adjacent printing of stereo-pairs can be automatically accomplished by appropriate programming of the printer. The proposed flat-bed printer will also facilitate multiple printing of any selected negative frame. This cannot presently be accomplished on a roll-type strip printer.

IV. Technical Specifications

Design parameters for the two contact printers were contained in separate specifications covering the "High Resolution Step and Repeat Contact Printer" for NPIC, dated 16 December 1963, and the "Contact Duplicating and Reseau Printer" for GIMRADA, dated 14 February 1964.

The development objectives set forth requirements for a high-precision, automatically operated, step-and-repeat, contact roll printer, capable of producing exposures of the highest possible quality, resolution and acutance, from roll film widths varying from 70mm to $9\frac{1}{2}$ inches in any selected frame length from $2\frac{1}{4}$ inches up to a maximum of 30 inches, and at a printing rate of 10 frames per minute. The printer will have automatic exposure control and automatic dodging. Provision will be made for programmed selective printing and multiple printing of selected frames. The printer will be contained in a daylight-operating, clean-room enclosure.

V. Contractor and Financial Arrangements

Proposals were solicited from a total of nine (9) commercial concerns best qualified in the technology of photographic printers. The companies solicited were:

[redacted]

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25X1 [redacted]

The requests for proposals covered two printers under separate specifications entitled: "Performance Requirements for High Resolution Step and Repeat Contact Printer" dated 16 December 1963; and "Contact Duplicating and Reseau Printer", dated 14 February 1964 for GIMRADA.

Only two of the invited bidders responded, as follows:

High-Resolution Printer "alone"	Reseau Printer "alone"	Both Printers Under Single Contract
25X1 [redacted]		

25X1 [redacted] has been selected as the successful bidder because of its superior understanding of the requirements as well as the problems involved and because of its extensive capabilities in all scientific areas necessary for accomplishing the specified objectives.

25X1 The [redacted] proposal was considered unacceptable. Their proposal covered only one of the printers and did not comprehend a flat-bed exposure aperture as specified, but proposed a pendulum-type action of the exposing aperture and light source in an arc. This is an adaptation of the drum-type printer and would retain several of the limitations inherent in the revolving-drum printing concept.

25X1 The [redacted] proposal, on the other hand, gave due consideration to the limitations and shortcomings imposed by the drum-type printer. Their proposal covered all requirements of the development objectives and included a comprehensive treatise on each major problem area where inventions or new concepts may be required to fully satisfy the requirements. Even more important, the 25X1 [redacted] has recognized the magnitude of the development and the variety of talents required for proper accomplishment of the objectives. To meet the challenge, they have acquired the consulting services of three photographic engineering specialists from the [redacted] 25X1 25X1 [redacted] and have proposed to collaborate with the [redacted] 25X1 [redacted] for certain aspects of the development for which that Corporation has proven capability.

The program will be carried out in three phases: (1) study, (2) breadboard, and (3) prototype. The Government reserves the right to terminate the program after either the study or breadboard phases should those efforts fail to meet expectations.

VI. Coordination

Information concerning the proposed program has been disseminated within the Agency and to other components of the community through the NPIC Technical Development Committee and the semi-annual NPIC Joint Procurement Meeting held on 28 February 1964.

VII. Security

The program is to be negotiated on an [redacted] Confidential basis and both association with the sponsor and the equipment itself are to be classified. 25X1